# Lewis River Case Study Final Report

A decision-support tool for assessing watershed-scale habitat recovery strategies for ESA-listed salmonids

## Appendix M: Historical Floodplain and Channel Reconstruction

May 2007

# Introduction

Channel change analyses were conducted on the historical floodplains of sections of both the North and East Fork Lewis. The historical analysis was divided into two projects – historical river morphology for the three reservoirs of the Lewis (Merwin, Yale, and Swift reservoirs), and a channel change analysis for a 23-km section of the lower East Fork River (Figure M-1).

The river morphology project was based on a 1938 U.S. Geologic Survey planar survey of the East Fork (to Lucia Falls) and the North Fork Lewis River scanned map series. This analysis included three sections of the upper North Fork Lewis River currently flooded by Merwin (15 km), Yale (18 km), and Swift (13 km) reservoirs. The purpose of this assessment was to provide a general understanding of historical stream conditions and historically available habitat. The East Fork channel change analysis was done for a twenty-three (river) kilometer section of the East Fork Lewis River, based on multiple years of aerial photo interpretation data. The purpose of this change analysis was to assess natural and modified stream channel characteristics in a floodplain environment. We were unable to combine the various sources for use in both projects because of inconsistencies in alignment and geographic transformation.

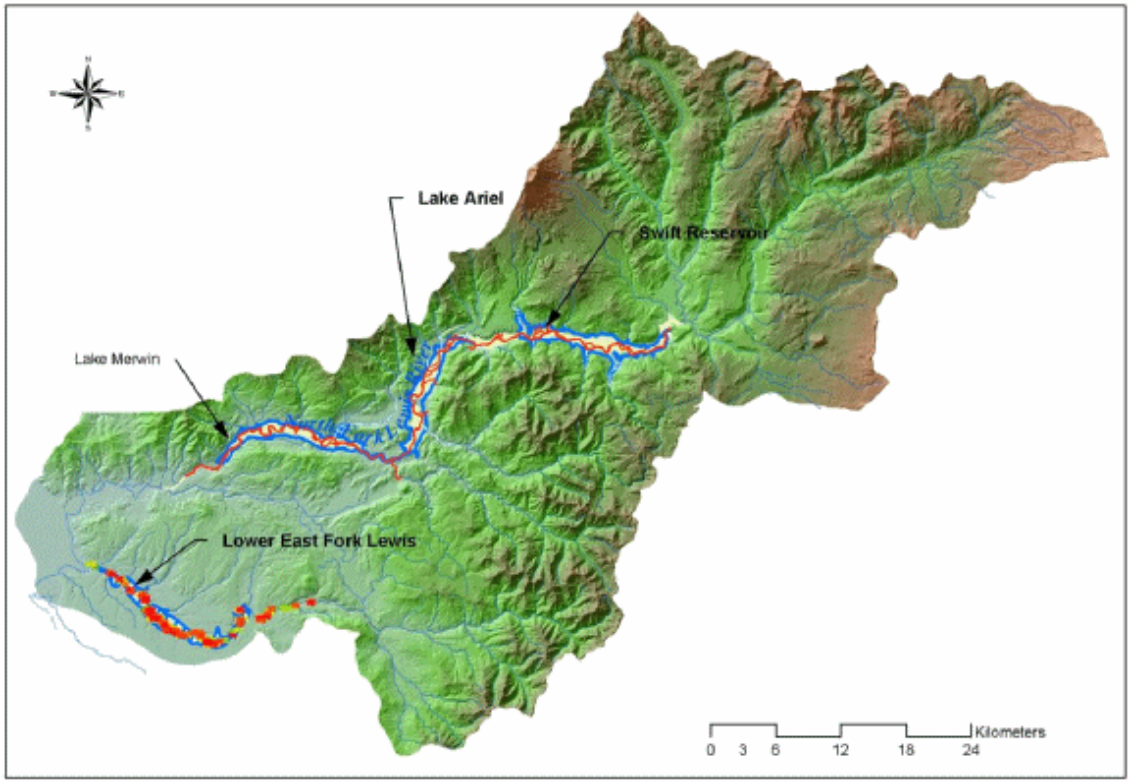


**Figure M-1: The four historical data sites in the Lewis watershed, three reservoirs and one floodplain river section. Red indicates historical channel data from Mylars, aerial photographs, or maps.**

## North Fork

The primary base map reference for the historical channel analysis were 1938 survey maps from the U.S. Geologic Survey (USGS). These maps were scanned and digitized, and the main channels, side channels, islands, tributaries, and contours were converted to GIS data layers using a scanning trace function (by private consultant) (Figure M-1). The maps depict the channels as double-banked channels, and the edge was determined from the location of the wetted shoreline.

Contours crossed the channel at every five-foot gain in elevation, though some steeper areas had contours every 1-2 feet. Each contour crossing was used to divide the river into a longitudinal series of channel sections. Main channels and side channels were broken into sections using this method, and the starting and ending elevations were identified for each section. Gradient was calculated by dividing change in elevation by the thalweg length of that channel section. For each section, perpendicular transects were created at three locations, and intersected with the channel section polygon to identify location and obtain bank to bank wetted width measurements from the U.S. Geological Survey maps. The three measurements were averaged to obtain wetted width for the section. Each section was identified as a main channel or secondary side channel. Some sections were further split to delineate the correct channel type.

Historical and aerial photos (1928, 1946-48) and narrative descriptions of historical conditions (Rice 1996; Cadastral survey notes, BLM 2000) were used to determine the size and composition of the vegetation at various locations along the river that is currently inundated by the three reservoirs. Based on these sources and descriptions, six categories of bank riparian vegetation were determined and identified for each stream section (Table M-1). Categories were extrapolated to similar sites and sections for the remainder of the reservoir. Data were mapped and summarized to represent historical channel and vegetated conditions for the river (Figure M-1).

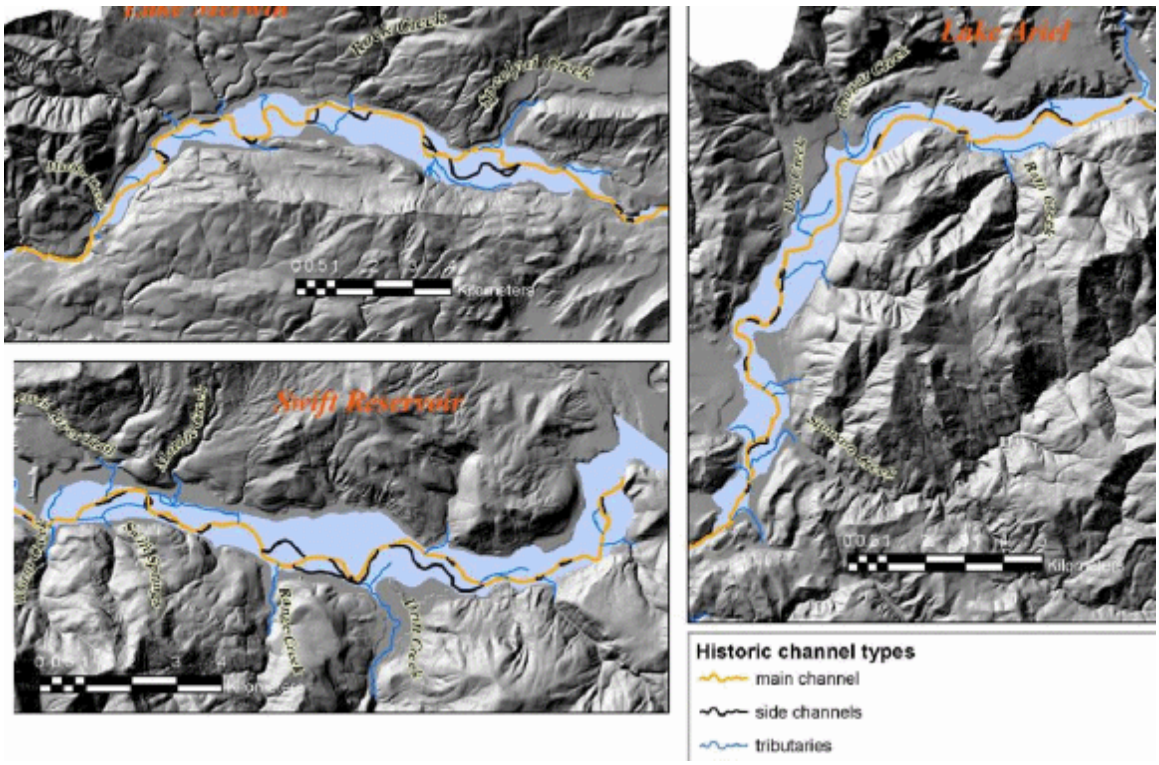


**Figure M-1. Historical channels in the North Fork Lewis River. The blue background indicates the extent of the historical floodplain, which coincides in most places with the lateral extent of the current reservoir. Main channels are in orange, side channels (both single and double side channels) are indicated in black.**

**Table M-1. Translation table by which historical riparian forest survey notes were used to estimate historical vegetation. The riparian identifier was used to classify each stream section with a particular pre-inundation riparian vegetation type.**

| Riparian ID | Location Description | Photo year | Seral Stage | (%) | | | Dominant Conifer (%) | Shade | Large Woody Debris | Pool Forming Conifers | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Conifer | Deciduous | Bare nonforest | | | | | |
| A & B | Upstream end of Merwin | 1948 | Late | 75% | 25% | | >=20" (50% con) | Good | Good | Good | |
| | DS Canyon Creek | 1948 | Late | 75% | 25% | | >=20" (50% con) | Good | Good | Good | |
| C | | 1948 | Early | 30% | 60% | 10%, herbs | >= 20" | Poor | Good | Fair | |
| D | 1/4 mile DS Siouxon & near Siouxon, lower Yale, | 1948 | Other (non-Con) | 0% | 40% | 60%, burn, grass | | Poor | Fair | Poor | |
| E | US Siouxon, near confluence, lower 1/2 of Yale | 1948 | Mid | 70% | 30% | | >= 20" | Good | Good | Good | Straight reaches, inside bends of meanders |
| E2 | US Siouxon, near confluence, lower 1/2 of Yale | 1948 | Other (non-Con) | | 90% | 10% | | Fair | Fair | Poor | Floodplain surfaces (within migration zone) |
| F | US Siouxon - upper end Yale Lake | 1948 | Late | 70% | 30% | | >=20" (50% con) | Good | Good | Good | Left, upslope of floodplain |
| A2 | US town of Cougar | 1954, 1957 | Mid | 70% | 30% | | >=20" (50% con) | Good | Good | Good | Both sides, upslope of floodplain |
| A3 | US town of Cougar | 1954, 1957 | Other (non-Con) | 50% | 50% | | 10-20" (70% con) | Good | Good | Fair | Floodplain surfaces (within migraion zone) |
| B | Tribs of Swift Reservoir | 1954, 1957 | Late / Mixed | 70% | 30% | | >=20" (50% con) | Good | Good | Good | Tributaries only - upslope of floodplain |

# East Fork

Aerial photographs from multiple time periods (1854, 1928, 1946, 1948, 1984, 1976, 1955, 1990) were available for sections of the Lewis. The base maps used were USGS 1:24,000 topographic quadrangle maps (1990). Tributaries, main channels, secondary channels, point bars and other features were identified on non-georeferenced aerial photos, and transferred onto Mylar sheets overlays referenced to USGS quad sheets, using primarily manual methods. Stereo pairs were used where possible. Only channel sections that differed from the most recent time period (1990) river channel maps were transferred to the color-coded Mylar sheets. Gaps in delineated channels were filled with the 1990 stream channel to delineate a complete length of channel for each time period. Stream channels were broken into sections by channel type (main, lateral side, slough).

Information for all years was converted to GIS format by scanning and digitizing the Mylars and attributing all lines with source year and other attributes. Four years of Mylar data were chosen (1854, 1928, 1955, and 1990) to map channel migration patterns in the lower East Fork Lewis River. These years were chosen based on completeness of aerial photo coverage. Analysis of section-by-section changes in main channel position and associated channel features (e.g., secondary channels, wetlands) was done by segmenting the floodplain into one-kilometer lateral slices, following methods of Oetter et al. (2004). Channel types and lengths within each lateral floodplain slice were summarized by year to obtain channel change results (Table M-1, Figure M-1, Figure M-2).

**Table M-1. Summary lengths (m) of historical channel characteristics for the lower East Fork Lewis River.**

| Section ID | MAIN CHANNEL | | | | SIDE CHANNELS | | | | BLIND CHANNELS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 1955 | 1928 | 1854 | 1990 | 1955 | 1928 | 1854 | 1990 | 1955 | 1928 | 1854 |
| 1 | 1183 | 1183 | 1183 | 1037 | 0 | 0 | 90 | 1254 | 2187 | 0 | 1159 | 0 |
| 2 | 1126 | 1126 | 1126 | 950 | 0 | 0 | 0 | 978 | 158 | 0 | 304 | 0 |
| 3 | 1353 | 1353 | 1400 | 1268 | 0 | 0 | 0 | 0 | 640 | 0 | 0 | 0 |
| 4 | 1060 | 1060 | 1215 | 1060 | 0 | 0 | 0 | 0 | 140 | 0 | 0 | 0 |
| 5 | 1105 | 1105 | 1488 | 1136 | 0 | 235 | 0 | 0 | 31 | 0 | 0 | 0 |
| 6 | 1540 | 1626 | 1491 | 1592 | 0 | 603 | 0 | 0 | 590 | 0 | 0 | 43 |
| 7 | 1546 | 1727 | 1273 | 1486 | 251 | 589 | 926 | 2337 | 0 | 0 | 0 | 0 |
| 8 | 1610 | 1214 | 1417 | 1180 | 1107 | 1032 | 41 | 4042 | 0 | 0 | 211 | 0 |
| 9 | 1043 | 1128 | 1335 | 953 | 204 | 820 | 0 | 303 | 0 | 0 | 0 | 0 |
| 10 | 1334 | 1428 | 1372 | 1363 | 202 | 427 | 0 | 0 | 0 | 0 | 102 | 0 |
| 11 | 1290 | 1279 | 1319 | 1358 | 649 | 1275 | 600 | 1509 | 1281 | 0 | 0 | 0 |
| 12 | 1381 | 1450 | 1483 | 1056 | 850 | 873 | 1036 | 534 | 135 | 0 | 45 | 0 |
| 13 | 1023 | 1005 | 1011 | 864 | 344 | 943 | 797 | 0 | 0 | 0 | 0 | 0 |
| 14 | 1007 | 1007 | 1007 | 1007 | 0 | 147 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 1317 | 1338 | 1366 | 1191 | 524 | 743 | 123 | 0 | 54 | 0 | 0 | 0 |
| 16 | 1359 | 1359 | 1344 | 1332 | 0 | 226 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 1637 | 1637 | 1582 | 1637 | 64 | 131 | 0 | 64 | 0 | 0 | 0 | 0 |
| 18 | 989 | 989 | 989 | 989 | 347 | 523 | 0 | 347 | 0 | 0 | 0 | 0 |

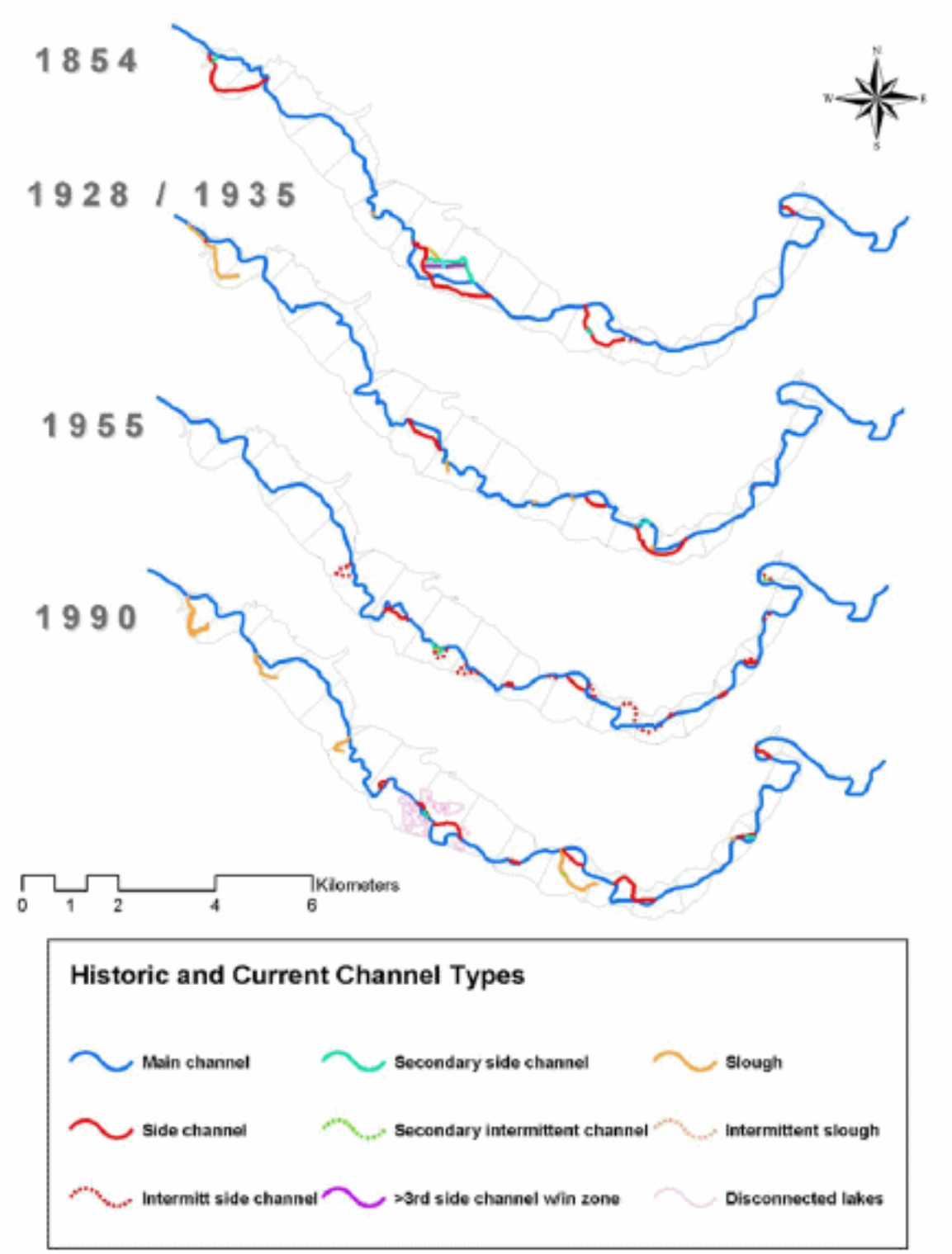


**Figure M-1. Historical channels for the lower section of the East Fork Lewis River. Four time periods are presented, and colors indicate channel characteristics for each. Lateral cross-sections on the maps indicate section area delineations used to measure differences in channel length between the years. The right side of the graphic(s) is upstream.**

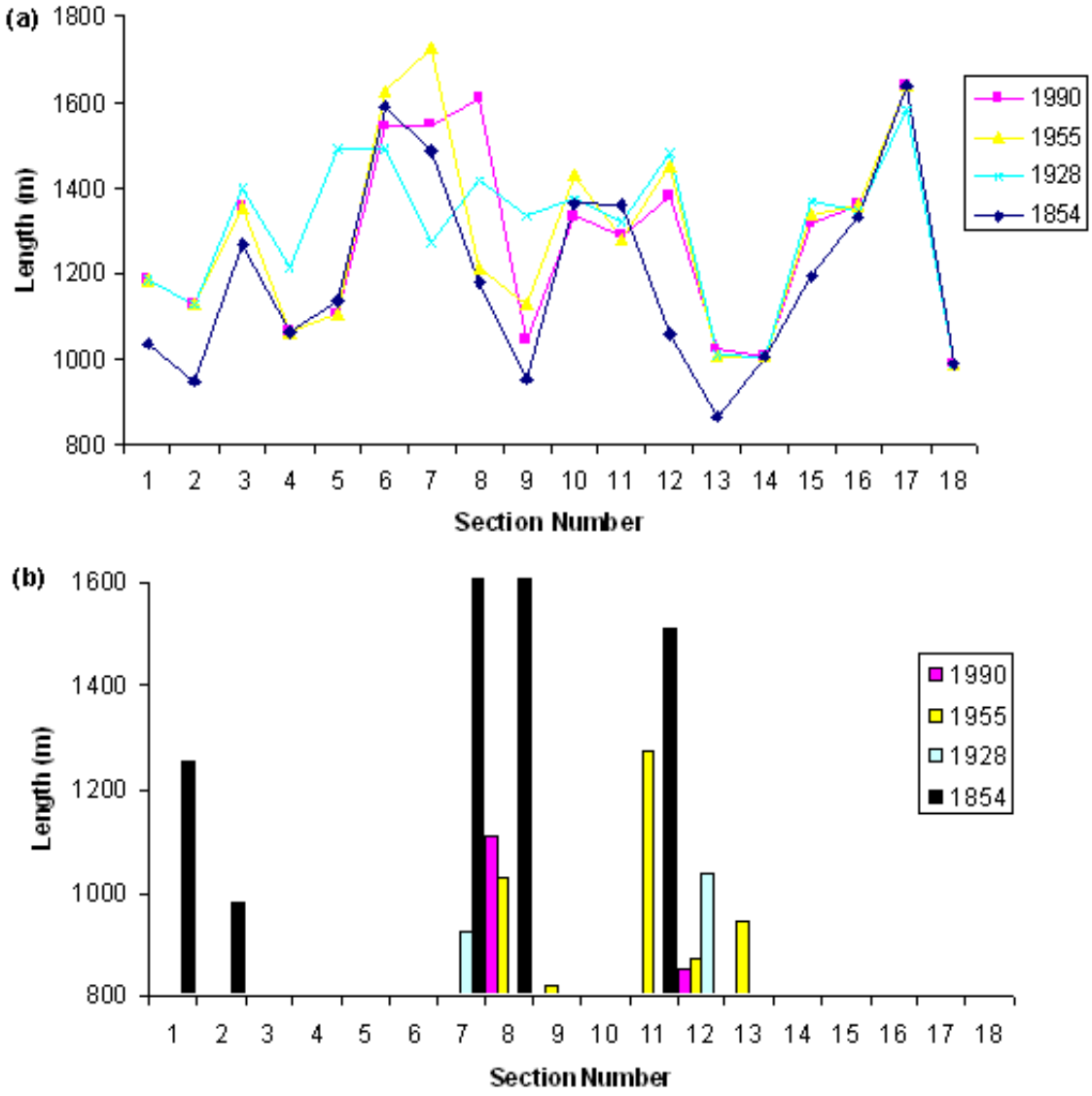


**Figure M-2: Channel length for historical channels in the lower section of the East Fork Lewis River. Graph (a) indicates channel length of the main channel by section, (b) presents the total length of side channels by section and year. Sections are numbered from downstream to upstream. Total length was 23 kilometers (based on 1990 main channel length for study area).**

## References

Rice, M. H. 1996. Pioneer Families of Yale Valley, Washington, Pioneer Research, Battle Ground, WA. 324 p.

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